Algal Growth on Beaks of Live Parrotfishes[1]

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ABSTRACT: The algal flora on the beaks of certain parrotfishes is described. No host-specific relationship exists between the algae and fishes. A direct correlation between the length of the algae and the size of the fish is present. The exposed dentition of the parrotfish merely provides another type of substratum on which algae grow.

IT HAS LONG BEEN KNOWN by island fishermen and biologists that an algal growth often occurs on the exposed beaks of certain parrotfishes (family Scaridae). However, specific information on this particular association is absent in the literature. The purpose of this paper is to describe the algal flora which occurs on the beaks of these fishes and to discuss any relationship that exists within this association.

Previous records of algae associated with other marine vertebrates are known from the Pacific region. *Pringshemiella acutata* (Reinke) Schmidt & Petrack, a green alga, occurs on the face and belly of the Hawaiian monk seal, *Monachus schauinslandi* Matschie (Kenyon and Rice, 1959). Tsuda (1965) reports a species of *Polysiphonia,* later described as *P. tsudana* by Hollenberg (1968), that forms dark red tufts on the neck of the green turtle, *Chelonia mydas* Linnaeus.

MATERIALS AND METHODS

Eighty-four specimens representing 15 species of parrotfishes were collected, either by spearing or poisoning, from five islands (Guam, Rota, Saipan, Maug, and Truk) in Micronesia over a year's period (April 1970 to April 1971). Sixty-eight of these specimens were obtained from the reefs of Guam.

The species, habitat description, and standard length of each specimen of parrotfish was recorded. The identification of the fishes is based on the review by Schultz (1958). The algae, when present, were scraped from the beak and quantified using a slight modification of the point method of Jones (1968). Eighty-one points on the ocular grid were used to obtain a relative abundance value for each algal species. The maximum length of the algal filaments was also recorded. The distance between the rictus and the center of the upper beak was also measured in 30 specimens merely to confirm that the beak increases in surface area as the fish matures.

RESULTS AND DISCUSSION

A total of 12 algal species was found on the beaks of the parrotfishes examined. The diatom *Licmophora* was also present but only as an epiphyte on other algae. Figure 1 illustrates the algal growth on the beak of a 456-mm-long *Scarus microrhinos.* Six species of parrotfishes had no algal growth on the beak. However, because of our low sample number, we are not able at this time to say that algae are excluded from these species.

Table 1 shows that the same algal species can be found on several species of fishes; thus, we can conclude that no host-specific relationship exists between them. *Ectocarpus indicus, Acrochaetium* sp., *Microcoleus lyngbyaceus,* and *Polysiphonia scopulorum* were the most frequently encountered, as well as the most abundant, algal species.

The relative abundance of the algal species not only differed among the different fish specimens but also differed in respect to its location on the beak. In six instances, the algae present on the four corners of the upper and lower beak

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ALGAL SPECIES ASSOCIATED WITH THE 15 SPECIES OF PARROTFISHES EXAMINED

SPECIES OF SCARIDAE	NUMBERS EXAMINED	RANGE OF S. L. (MM)	NO ALGAE	ALGAL SPECIES											
				Cyanophyta					*Chlorophyta*		*Phaeophyta*		*Rhodophyta*		
				Entophysalis deusta (Menegh.) Dr. & Daily	*Microcoleus lyngbyaceus* (Kütz.) Crouan	*Schizothrix calcicola* (Ag.) Gom.	*Schizothrix mexicana* Gom.	*Spirulina subsalsa* Gom.	*Cladophora* sp.	*Derbesia* sp.	*Ectocarpus indicus* Sonder	*Sphacelaria tribuloides* Meneg.	*Acrochaetium* sp.	*Polysiphonia scopulorum* Harvey	*Tolypiocladia glomerulata* (Ag.) Schm. & Hauptfl.
Calotomus spinidens (Quoy & Gaimard)	2	134–163				X					X	X			
Chlorurus bicolor (Ruppell)	3	48–455	X												
Chlorurus gibbus (Ruppell)	1	125	X												
Scarops rubriviolaceus (Bleeker)	2	340–360								X	X			X	
Scarus bleekeri (Weber & de Beaufort)	1	169	X												
Scarus brevifilis (Gunther)	5	270–318			X	X					X	X	X	X	
Scarus chlorodon Jenyns	8	270–380			X	X				X	X	X	X	X	
Scarus flavipectoralis Schultz	1	173	X												
Scarus jonesi (Streets)	2	281–345								X			X	X	
Scarus lepidus Jenyns	3	228–231			X				X				X		
Scarus microrhinos Bleeker	14	183–490		X	X	X		X		X	X	X	X	X	
Scarus oedema (Snyder)	1	192	X												
Scarus pectoralis Cuvier & Valenciennes	3	279–304				X			X	X	X				
Scarus sordidus Forskal	34	76–470			X	X	X			X	X		X	X	X
Scarus venosus Cuvier & Valenciennes	4	148–214	X												

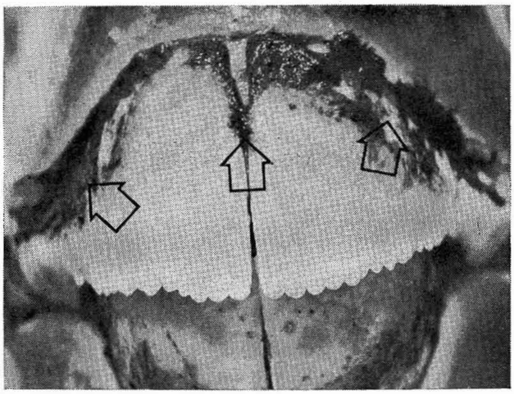

FIG. 1. Algal species *Polysiphonia scopulorum* and *Sphacelaria tribuloides* on the beak of *Scarus microrhinos*.

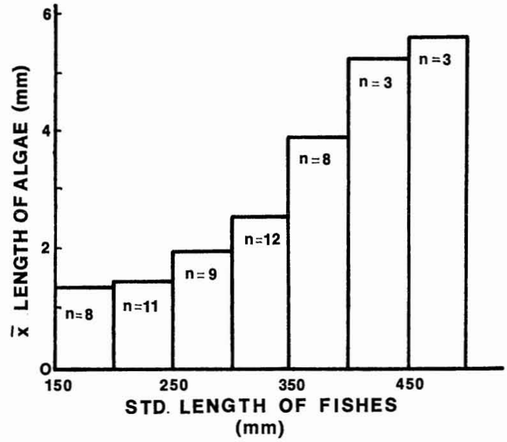

FIG. 2. Histogram showing mean length of algae in relationship to the standard length of fishes. (N = number of fishes in each size group.)

differed in terms of relative abundance and species composition. An example of this can be seen on a 470-mm-long *Scarus sordidus* which had on its upper jaw a pure stand of *Ectocarpus indicus* on the left dental plate and 98 percent *Polysiphonia scopulorum* on the right dental plate. On the lower jaw, *Derbesia* sp. was the only alga on the right dental plate, whereas both *Derbesia* sp. and *Extocarpus indicus* were found in equal abundance on the left dental plate. The algae present on the parrotfishes can be found all year round and represent pioneer species in ecological succession.

The only direct relationship that exists between the algae and the parrotfishes was the increasing length of the algal filaments with the increasing size of the fishes. Figure 2 shows this relationship quite clearly when all of the fishes, regardless of species, are arranged in six size groups. It should be noted that a normal growth curve is represented here. *Ectocarpus indicus, Sphacelaria tribuloides,* and *Polysiphonia scopulorum* were the three algal species showing an increased length on larger fishes. The fact that larger fishes had longer filaments of algae is not surprising since island fishermen often express the size of the fish caught in terms of the length of algae growing on the beak.

Regardless of species, any parrotfish less than 150 mm in standard length was completely devoid of algae. Except for six specimens, all fishes between 150 and 199 mm in standard length lacked algae. This may be due to the presence of the lip that covers most of the beak in smaller specimens.

A single specimen of parrotfish could have as many as five different algal species on its beak at a given time. When the mean number of algal species per fish size group was analyzed, the values simply showed that the larger fishes with larger dentition were capable of supporting more algal species.

A particular algal species showed no correlation with different size groups of fish. However, there was a general tendency for the blue-green algae, as a group, to diminish in relative abundance with increasing size of the fishes. The blue-green algae always made up less than 5 percent of all algae on the beaks of parrotfishes larger than 350 mm in standard length. Likewise, there was a tendency for the relative abundance of the other three algal divisions to predominate on larger fishes.

Fishes collected in the same area on Guam did not possess the same algal species, even when the fish size groups were considered. There was also no correlation between the algal species and the fish specimens collected during a certain month.

All of the parrotfishes examined had a mucoid substance coating the corners of the exposed dental plates, and we suspect that this provides the mechanism by which algal spores or zygotes can adhere to the beak. The presence of bacteria was also conspicuous in some of the mucus examined. The fishes could easily pick up algal cells while feeding, sleeping, or even swimming. Any relationship between the mucus found on the beak and the mucous envelope (Winn, 1955) secreted by certain parrotfishes at night is presently unknown to us.

As a fish increases in size, its beak also increases in exposed surface area (Fig. 3), thereby providing more substratum for the algae to spread toward the center. Fewer algae grow on the larger region at the center of the beak (see Fig. 1), apparently because the rasping action of the parrotfish while feeding on calcareous substrata scrapes the algae from this portion of the beak. Algae are usually absent also from the center portion of the lower beak because the upper beak in overlapping partially scrapes over the lower one. However, if the lower beak is indented as a result of damage, so that it is free from scraping action, algae can also be found at this site. Such a case was observed in a 215-mm-long *Scarus sordidus*.

Algal growth is not restricted to parrotfishes: a specimen of *Diodon hystrix* Linnaeus (family Diodontidae) was also found to possess an algal flora on its exposed beak.

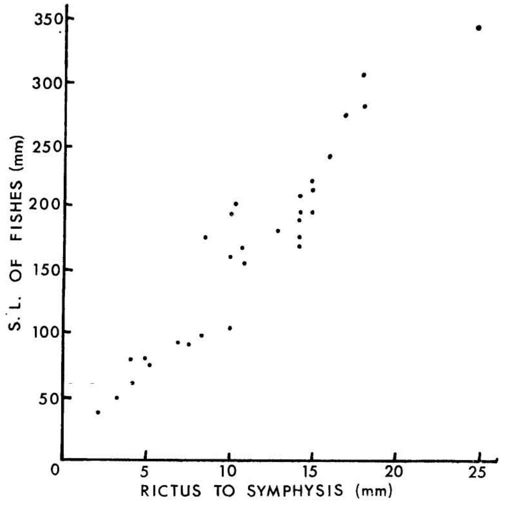

FIG. 3. Scatter diagram showing relationship between standard length (S.L.) of fishes and size of beak.

CONCLUSIONS

A number of attached algae of pioneer short-lived types occurs on the exposed beaks of parrotfishes. We have not found any special adaptive significance in this association that in any way can be advantageous to the fish. The exposed beak of the parrotfish merely seems to provide another type of substratum; i.e., it is a moving reef on which algae can grow. Algal growth is not restricted to parrotfishes but also occurs on *Diodon hystrix.*

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